NAVIFINDER-200
Electronic Compass Module with LCD

Application Notes Version 1.0
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1.0 PRODUCT DESCRIPTION

Precision Navigation, Inc.'s Navifinder-200 is a solid state electronic compass module with a liquid crystal display (LCD) that displays digital heading along with cardinal points. Its sophisticated magnetic interference correction algorithms enable the compass to work accurately in a harsh vehicle environment.

The Navifinder-200 is the first low cost electronic OEM compass module with a display. It can be easily mounted in a dash or enclosed in a housing. The module can be powered by the vehicle's 12 volt battery and ignition system or by an externally mounted on/off switch and battery.

2.0 OVERVIEW OF TECHNOLOGY

The Navifinder-200 uses Magneto-Inductive Magnetic Sensor Technology. A Magneto-Inductive magnetic sensor is **not** a fluxgate, but a patented new technology that out performs all other magnetic sensors in its class. These sensors are used as compasses in GM, Chrysler, and Ford vehicles. Two perpendicular axes of these Magneto-Inductive sensors provide the magnetic information to calculate the compass heading and cardinal points in the Navifinder-200.

The Navifinder-200 is accurate in a variety of environments. Ferrous metal in host systems such as cars magnetize over time and generate magnetic fields that can be more than 10 times the strength of the earth's field. These magnetic fields cause inaccurate compass heading. The Navifinder-200 has built in algorithms to calibrate out the effects of the magnetic fields generated by the host system.

3.0 PRODUCT SPECIFICATIONS

- **Accuracy:** +/- 2 °
- **Resolution:** 5°
- **Output:** Liquid Crystal Display
  Heading is displayed in digits with 8 cardinal points.
- **Dimensions:** 1.75" x 3.47" x 1.19"
  (44.4 mm x 88 mm x 30.23 mm)
- **Mounting:** Mount within 30° of vertical for different viewing angles.
- **Operating Temperature:** -10 °C to 60°C
- **Power:** 6 - 18 V DC unregulated

- **Current draw:** Idle: 3.5 mA
  On: 5 mA average

4.0 APPLICATION

The Navifinder-200 can be installed in any system that requires a compass with display at low cost. The Navifinder-200 is used by Bayliner boats for their dashboard compass. The Navifinder-200 is not limited to use in boats; other applications include use in recreational vehicles (RV, snowmobile, motorcycle), van conversions, cars, trucks, and antenna positioning devices.

5.0 PHYSICAL LAYOUT

Appendix A contains diagrams showing the physical layout of the Navifinder-200. These diagrams contains all of the dimensions for the Navifinder-200 needed when mounting or housing the compass.

6.0 INSTALLATION AND MOUNTING

6.1 Housings

Ideally, the compass housing or dash material should not have a magnetic field or be made of a ferrous material. In practice, your vehicle will have some magnetic field associated with it. The Navifinder-200 can calibrate for magnetic fields associated with your vehicle, as long as the fields are not too strong. To avoid saturating the sensors, use non-ferrous materials near the Navifinder-200. Plastic, wood, brass and aluminum are examples of non-magnetic housing or dash materials. If you are not sure if a material is appropriate, try to stick a refrigerator magnet to it; if it sticks, try to keep it away from the Navifinder-200. Magnetic fields drop in strength very quickly with distance, so even a few inches can make a big difference to the compass. We do not recommend or offer any particular housing because our customers have very different requirements.

6.2 Conformal Coatings

For using the Navifinder-200 with boats, marine-type activities, or other uses that may expose the circuit board to moisture or dirt, conformal coating is recommended. However conformal coating voids the warranty (if any applies) if the coating or potting material interferes with repair or otherwise damages the Navifinder-200.

6.3 Mounting Specifications

There are four holes on the module to mount the compass. The mounting holes are 0.156" in diameter. The mounting holes will accommodate a #6 screw. Figure 1 shows the position of the bolt holes on the compass module. The compass should be mounted with even pressure on the four bolts to prevent warping of the circuit board.

The Navifinder-200 was designed to be mounted vertically. The compass modu can be mounted tilted as much as 30° from vertical for easier viewing.

7.0 ELECTRICAL CONNECTIONS

7.1 Specific Connector

An *Amp* Connector (Part # 172166-1) is needed as a mate to the connector on the Navifinder-200. *Amp* crimp pins (170365-1) should be used with the connector housing.

7.2 Electrical Connections

Figure 1 shows the connector on the Navifinder-200. From top to bottom, the pins are power, ignition and ground. The voltage supplied to the Navifinder-200 should be in the range 6-18 VDC unregulated. The Navifinder will draw a maximum of 6 mA. The power pin should always be powered so that the Navifinder retains its calibration. The ignition pin should receive power when you want the Navifinder on. Disconnect this pin from power when you want the Navifinder-200 off. The ground pin should be connected to ground. The Navifinder will draw about 5 mA in operation, and about 3.5 mA when idle.

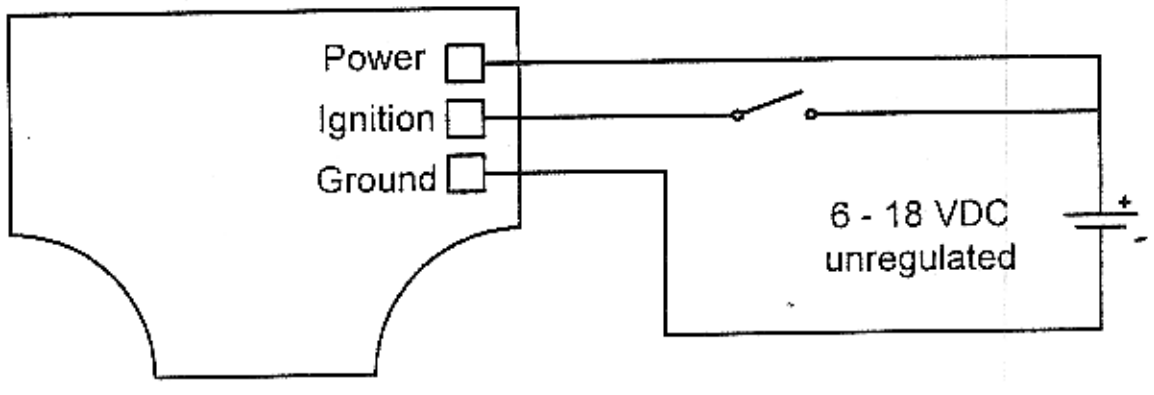


Figure 1. Electrical Connections to the Navifinder-200

8.0 CALIBRATION

8.1 Overview of Magnetic Fields

The Navifinder-200 has sophisticated correction algorithms built in to allow the compass module to give correct magnetic headings even in a harsh vehicle environment. The Navifinder-200 can calibrates for constant magnetic fields in the host vehicle system as long as the fields do not saturate the compass sensors.

Static (unchanging) fields create "hard iron" distortion. These fields can be mathematically modeled as a constant offset when they are always in the same place with respect to the Navifinder-200. The Navifinder can correct for any static magnetic field that does not saturate the sensors. No compass can calibrate out the effect of changing magnetic fields. The effect of the changing field can be minimized by mounting the Navifinder-200 as far as possible from the source of the distortion.

Magnetic fields from sources which are not part of the host system will interfere with the calculation of compass heading. For example, the Navifinder-200 heading might change by a few degrees driving by a steel bridge. This is not the fault of the compass; it is simply that Earth's magnetic field is distorted by magnetic objects.

8.2 When to Calibrate

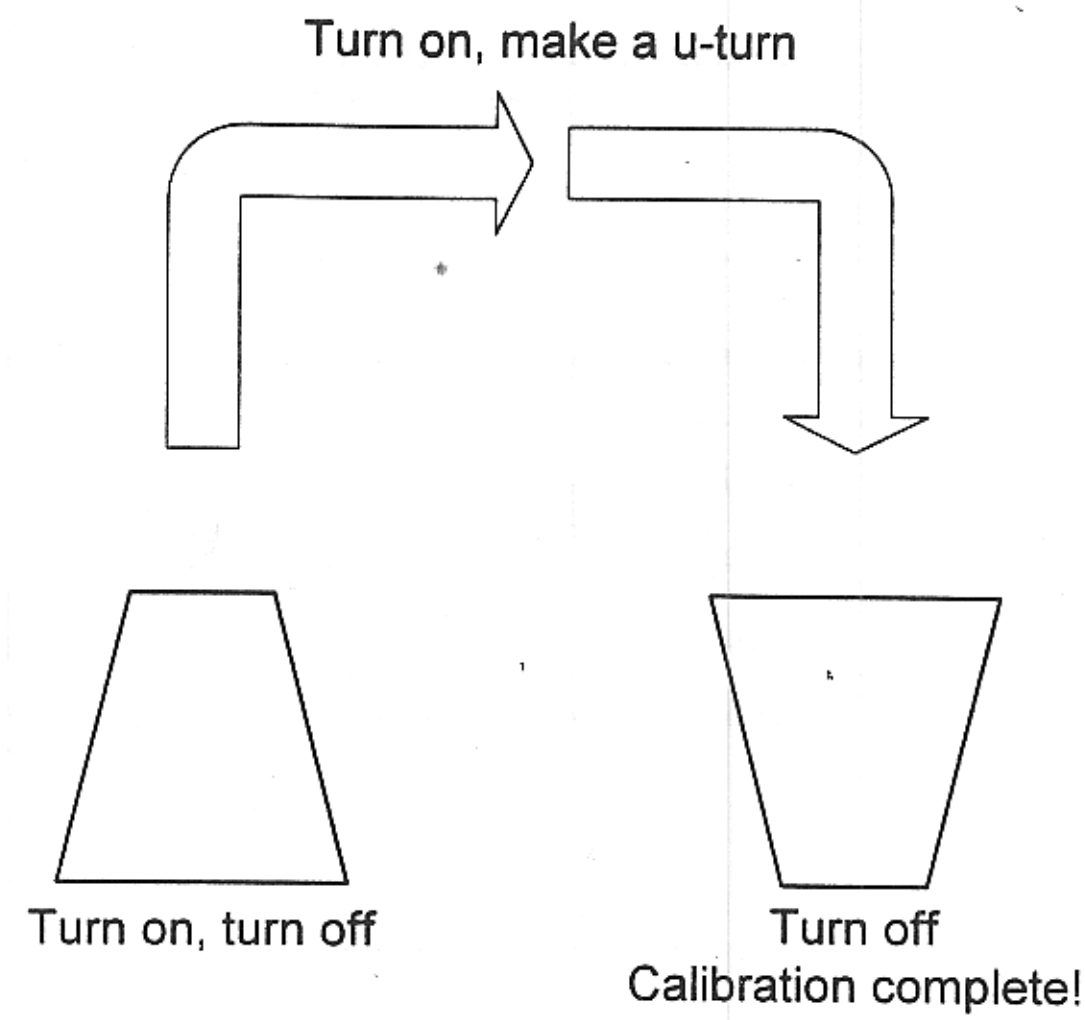
The Navifinder-200 needs to be calibrated when it is first installed or whenever the power source is disconnected (i.e. changing your battery or battery loses power). Over time, your vehicle's magnetic signature may change. This happens as the metal in your vehicle is slowly magnetized by Earth's magnetic field. This means that periodic recalibration could be necessary if you suspect you are getting inaccurate readings.

8.3 How to Calibrate

There are three steps required to calibrate your new Navifinder-200.

1. Install the Navifinder-200 and wire all connections. Supply power to the Navifinder-200.
2. With your vehicle in a level position, turn on the ignition (supply power to the ignition pin.) The CAL indicator will come on, and the "u-turn" indicator will slowly flash. After about 10 seconds, turn off the ignition. This tells the Navifinder to take the first calibration point.
3. Now turn on the ignition, and make a U-turn in your vehicle. Try to get as close to a 180° turn as possible. When you have positioned your vehicle, turn off the ignition. This tells the Navifinder-200 to take the second calibration point. The CAL indicator will go off.

Now when you turn on the ignition, the Navifinder-200 will display your current magnetic heading. The module will keep its calibration as long as power is supplied to the power pin.



For a good calibration, remember these points:

- Stay away from large metal objects during the calibration
- Make as close to an exact u-turn as you can
- Try to be level when you take your calibration points

Appendix A. PHYSICAL LAYOUT